CORRELATION PLEIADS OF COLLEMBOLA IN CONIFEROUS FORESTS

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КОРРЕЛЯЦИОННЫЕ ПЛЕЯДЫ КОЛЛЕМБОЛ В ХВОЙНЫХ ЛЕСАХ

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The collembolan population structure was studied in coniferous forests of different subzones. 57 spruce and pine stands were examined and in each stand 15-20 samples or more were taken. A definite set of mass species is characteristic of the collembolan population in the same forest types, and this set is relatively constant from the forest - tundra to the mixed forest subzone (Kuznetzova, 1985). It is interesting to consider such stability of specific structure of the collembolan population with specise reference to species microdistribution to see if there are close interspecific relationships within the complex of the mass forms.

The Pearson matching correlation coefficients for each biotope were calculated excluding those with low number. Pairs of species with a significant positive correlation ($p = 0.05$) were regarded as correlation pleiads, outlining species which are closely interrelated in the space. Our aim was to establish the general features of their structure and their variation under the impact of different factors.

From 1 to 3 correlation pleiads of springtails were found in each biotope, each including from 2 to 11 species. As a rule, the complex of dominants and subdominants was not fully represented in a pleiad.

The correlation pleiad is characterized by its relative capacity (G)(Terentjev, Rostova, 1977). $G = \frac{R}{N}$, where R is the number of significant positive correlations between the species, N - the number of species in a pleiad. G = 0.5-1.0 for the week friable pleiades and is above 2 for the rigid pleiads with high capacity.

The structure of a pleiad is a function of the following factors:

1. Humidity of the biotope. The relative capacity of the correlation pleiads in an ecological series of spruce stands arranged according to the soil humidity gradient is the highest in the dry Piceetum vacciniosum stand and is significantly lower in the P.sphagnosum stand, where only few simple pleiads were found (Fig.).

2. Weather conditions. In the same biotopes the number of correlations increased during dry and hot periods against wetter and colder ones (see Fig.).

3. Age of the stand. In the same region of south taiga (Darvin Nature Reserve) the correlation pleiads of springtails were different in the associations of Piceetum myrtillosum of 60 and 180 years old. In a middle-aged stand the value of G was only 1.3, while in an old one it reached 3.3.

4. Zonal-climatic conditions. In the subzone of forest-tundra, correlations between collembolan species are rare, the correlation pleiads friable. The most rigid structures were found in the subzone of mixed forests.

T a b l e 1. Composition of collembolan correlation pleiads in the different spruce stands (Arkhangelsk region, 1980)

Mass species	Piceetum vacciniosum	Piceetum myrtillosum	Interspecific relationships in correlation pleiads	Piceetum vacciniosum	Piceetum myrtillosum
Isotomiella minor	+	+	I.minor x I.hiemalis	+	-
Isotoma hiemalis	+	+	I.hiemalis x F.quadrioculata	+	-
Folsomia quadrioculata	+	+	I.hiemalis x W.aspinata	+	-
Willemia aspinata	+	+	F.quadrioculata x W.aspinata	+	-
W.anophthalma	+	+	X.grisea x I.hiemalis	+	-
Micranurida pygmaea	+	+	F.quadrioculata x X.grisea	+	-
Xenylla grisea	+	+	O.absoloni x W.aspinata	+	-
Oligaphorura absoloni	+	+	M.gr.krausbaueri x I.minor	+	-
Protaphorura nemorata	+	+	O.absoloni x M.gr.krausbaueri	+	-
Mesaphorura gr.krausbaueri	+	+	O.absoloni x P.nemorata	+	+
Anurophorus septentrionalis	+	-	I.minor x W.aspinata	+	+
Pseudanurophorus binoculatus	-	+	M.pygmaea x I.minor	-	+
Friesea mirabilis	-	+	M.pygmaea x W.anophthalma	-	+
Megalothorax minimus	-	+	F.mirabilis x F.quadrioculata	-	+
			O.absoloni x W.anophthalma	-	+
			P.binoculatus x P.nemorata	-	+
			I.hiemalis x M.gr.krausbaueri	-	+
			I.minor x M.minimus	-	+

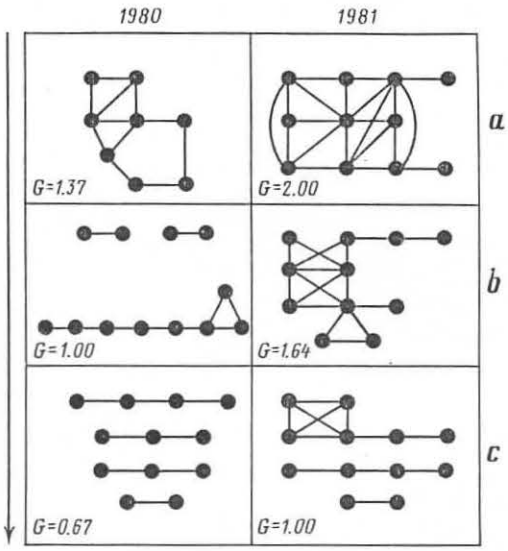
T a b l e 2. Composition of collembolan correlation pleiads in the same area of Pinetum myrtillosum association (Darvin Reserve) in different years

Species	Species included into: set of mass species		correlation pleiads		Interspecific relationships		
	1981	1982	1981	1982		1981	1982
Anurophorus septentrionalis	+	-	+	-	M.gr.krausbaueri x x W.anophthalma	+	-
Willemia aspinata	+	+	+	-	W.aspinata x M.gr.		
W.anophthalma	+	+	+	-	krausbaueri	+	-
Isotoma notabilis	+	+	+	-	M.pygmaea x M.gr.		
I.hiemalis	+	+	+	-	krausbaueri	+	-
Folsomia quadriocu-					A.septentrionalis x		
lata	+	+	+	+	x M.pygmaea	+	-
Micranurida pygmaea	+	+	+	+	W.anophthalma x		
Mesaphorura gr.					x I.hiemalis	+	-
krausbaueri	+	+	+	+	O.absoloni x I.no-		
Oligaphorura abso-					tabilis	+	-
loni	+	+	+	+	O.absoloni x I.lig-		
Isotomiella minor	+	+	-	+	norum	-	+
Lepidocyrtus lignorum	+	+	-	+	W.aspinata x O.ab-		
Pogonognathellus fla-					soloni	-	+
vescens	+	+	-	-	M.pygmaea x O.ab-		
Megalothorax minimus	+	+	-	-	soloni	-	+
Sphaeridia pumilis	-	+	-	+	I.minor x M.gr.		
Arrhopalites princi-					krausbaueri	-	+
palis	-	+	-	+	A.principalis x		
					x S.pumilis	-	+

Thus, the complexity of collembolan correlation pleiads structure has a tendency to increase in the drier zonal-climatic or landscape conditions. The structure of a pleiad fluctuates in time becoming more complicated during the dry periods and more simple during the wet ones. The number of interspecific correlations rises with age of the stand.

The formation of collembolan correlation pleiads may be determined both by mosaicism of environmental conditions and by interspecific relationships. In the last case the correlation between the species must be stable enough. In different forest types, however, the identical combination of species occurs rarely even where the sets of mass species are similar (Table 1). Combinations of the certain species are highly unstable in time (Table 2). They are retained for only 2-3 months.

Thus, the interspecific correlations in the collembolan populations are extremely variable in spite of relative stability of the mass species set. The major factors for the formation of pleiads in the coniferous forests litter are the environmental conditions: microclimate, weather and, presumably,



Correlation pleiads of Collembola in the fir forests of the south of Arkhangelsk region

Arrow means the increase of humidity: a - Piceetum vacciniosum, b - P.myrtillosum, c - P.sphagnosum

the type of food resources (soil fungi). In fact, it was shown (Borisova et al., 1985) that Hyphomyceta of forest litter in the Carpathians also are organized into the analogous pleiades. It can be concluded that the composition and structure of collembolan correlation pleiads may be used for environmental monitoring.

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